



73rd MORSS CD Cover Page

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712CD

For office use only 41205

21-23 June 2005, at US Military Academy, West Point, NY

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Original title on 712 A/B: **Performance Operational Risk Assessment Tool (SPORAT)**

Revised title: _____

Presented in (input and Bold one): (WG **27**, CG____, Special Session ____, Poster, Demo, or Tutorial):

This presentation is believed to be:

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Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE 23 JUN 2005		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE System Performance Operational Risk Assessment Tool (SPORAT)				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army Aviation and Missile Command Bldg 5308 Room 8440 Redstone, AL 35898				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM201946, Military Operations Research Society Symposium (73rd) Held in West Point, NY on 21-23 June 2005. , The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 17	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



System Performance Operational Risk Assessment Tool SPORAT

73rd MORSS
21-23 June 2005

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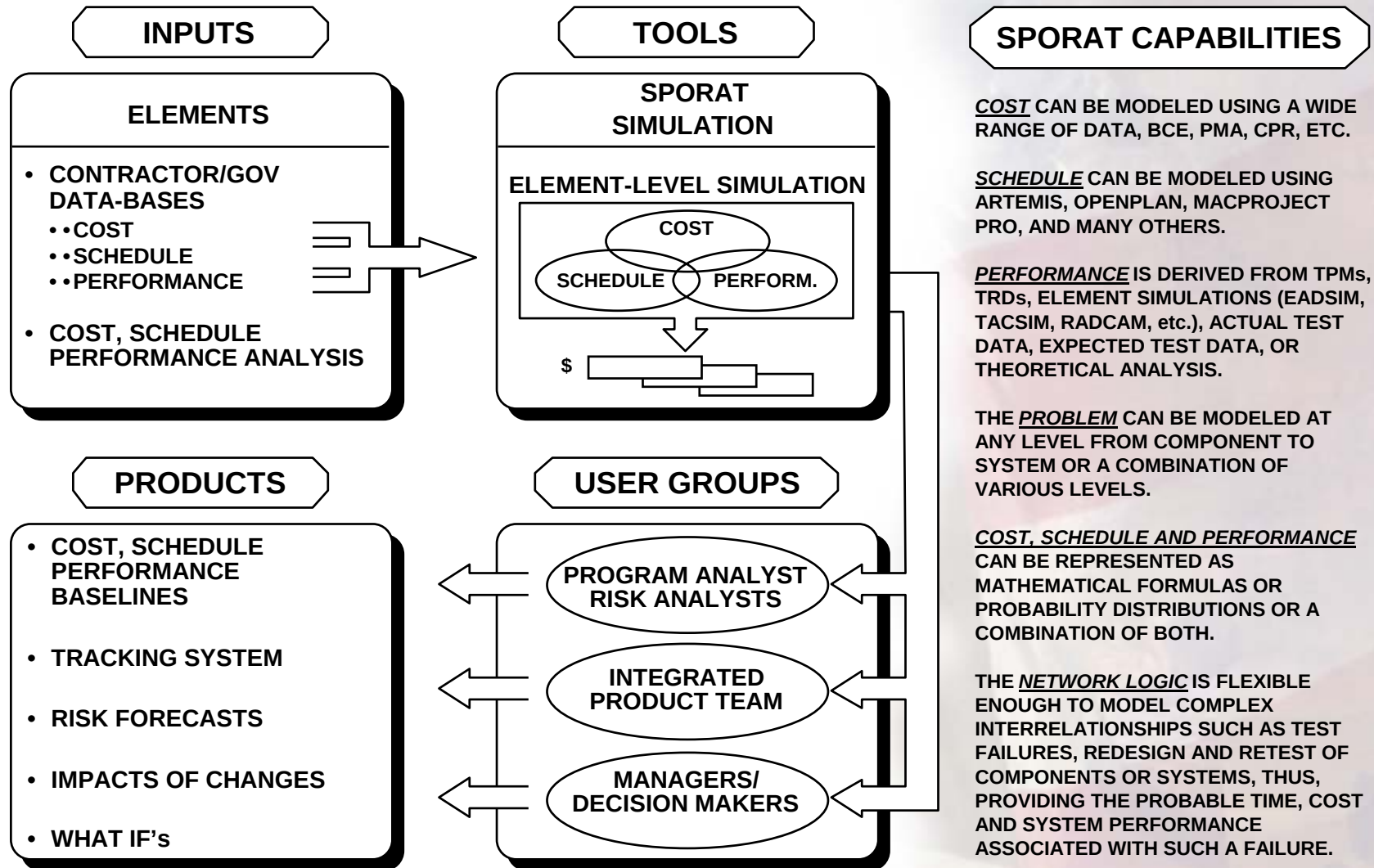
Purpose

- **Performance as a variable in decision risk assessment**
- **Define the relationship of system availability from acquisition development to battlefield consequences.**
- **Define the cost risk methodology**

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System Performance Operational Risk Assessment Tool (SPORAT) Concept



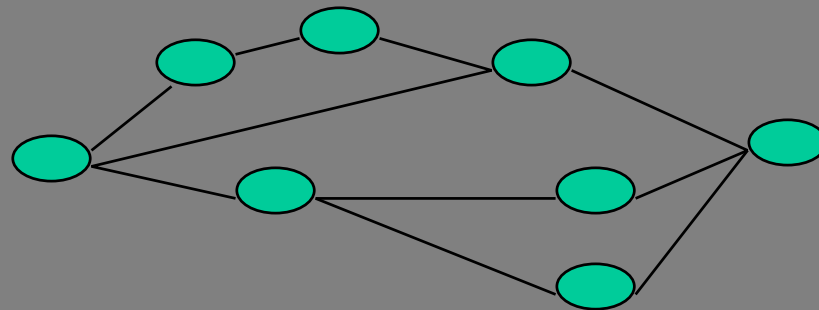
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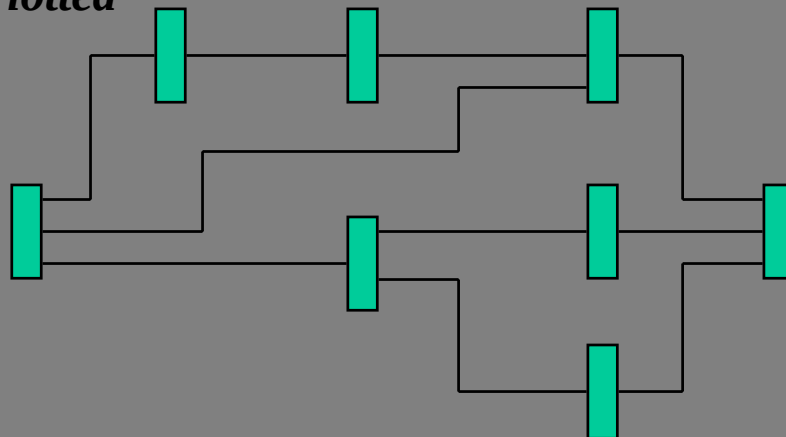
Network Development

- Logic network of project
- Initial development by benchmark
- Decomposition of benchmark activities
- Assignment of activity durations
- IPT quality review
- Input logic activities into SPORAT
- IPT final verification and validation

Hand Drawn



Plotted



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Overall TPP Matrix

TECHNICAL PERFORMANCE PARAMETER	APPLIED	CONDITIONS FOR DRAW	CONSEQUENCES IF A FAILURE OCCURS		
			TYPE	HARDWARE	SOFTWARE
TRACK FILE OBJECTS (NUMBER)	BM 0.5 N311-N370 BM 1.0 N591-N600 BM 2.0 N730-N731	NORMAL DISTRIBUTION MAX 200, MIN 1 BM 0.5 - MEAN 100, 3 SEC STD 10 BM 1.0 - MEAN 100, 3 SEC STD 10 BM 2.0 - MEAN 100, 3 SEC STD 5	REWORK		TIME & COST 5%-10% DIST.
TRACK UPDATE LATENCY (SECONDS)	BM 0.5 N465-N490 BM 1.0 N601-N602 BM 2.0 N740-N741		REWORK		DIST. 35%-50%
TRACK PURGE (SECONDS)	BM 1.0 N604-N605		REWORK		TIME & COST 10%-20% DIST.
MESSAGE HANDLING RATE (MSGs PER SEC)	BM 1.0 N652-N660	GAMMA DIST. R=2 MAX 50, MIN 5, 1 SEC MEAN 17 STD 12	REWORK	15% HW COST	TIME & COST 5%-10% DIST.
MESSAGE HANDLING LATENCY (SECONDS)	BM 1.0 N654-N655		REWORK		TIME & COST 10%-20% DIST.
C ² PROCESSING		NORMAL DIST. MAX 200, MIN 100 MEAN 100 STD 30			

- SOFTWARE REWORK NOT LESS THAN ONE DAY
- HARDWARE UPGRADE INCLUDES COST PLUS ONE WEEK DELIVERY DELAY

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How TPP's are Applied

- Tracked Objects Database
- Incoming Sensor Data Sets
- Designation of Objects to be Updated

UPDATE OBJECT ASSIGNMENTS

- New Object-Data Association

- Accuracy of Correlations
- Number of Hits Needed for Correlation
- Correlation Cycle Timeline
- False Correlations
- Correctness of Correlation Thresholds
- Robustness in Utilization of Inaccurate or Incomplete Sensor Data
- Erroneous Object Updates
- Are Correlation Thresholds Being Met?
- Task Processing Timelines

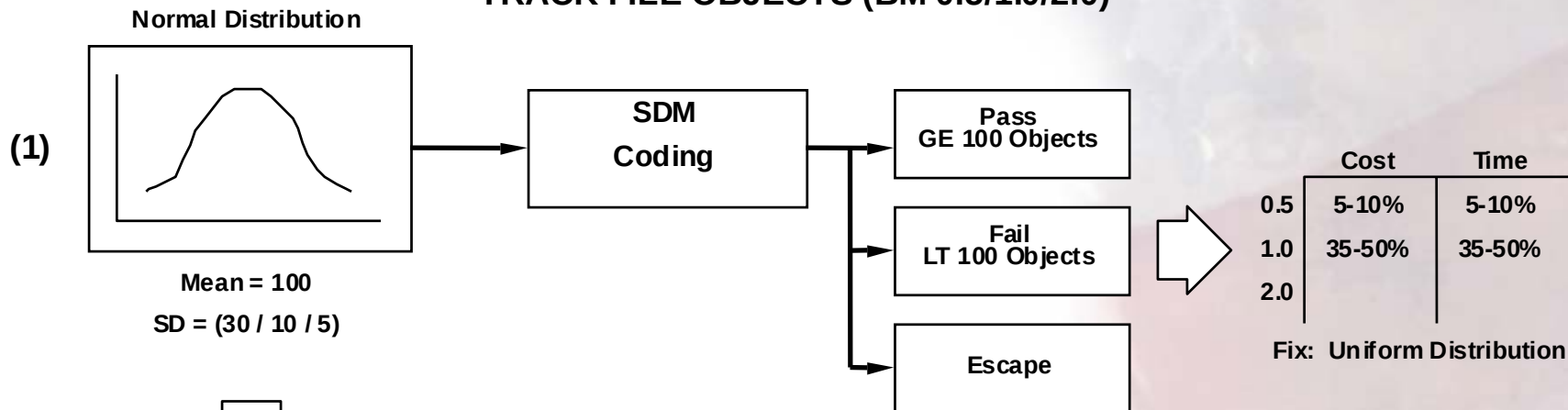
Technical Performance Parameter	Metric
• Accuracy of Object Correlations	• Percent of Correct Correlations
• Number of Hits Needed for Correlation	• Average Counts of Hits (#)
• Correlation Cycle Timeline	• Average Time

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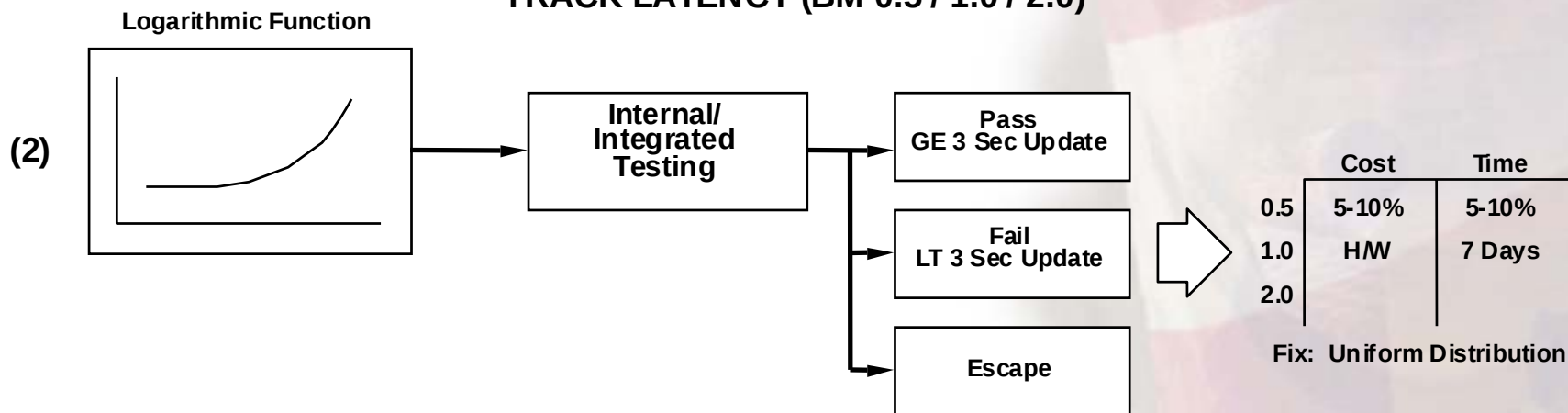
Application of TPPs

TRACK FILE OBJECTS (BM 0.5/1.0/2.0)



Results

TRACK LATENCY (BM 0.5 / 1.0 / 2.0)



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Software Integration Phase 5

Cost

Item	Category	Unit	Quantity	Unit Price	Total Price	Start Date	End Date	Actual Price	Actual Date	Actual Quantity	Actual Unit Price	Actual Total Price
101	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
102	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
103	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
104	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
105	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
106	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
107	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
108	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
109	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00
110	Software	Line Item	1	100.00	100.00	1/1/00	12/31/00	100.00	12/31/00	1	100.00	100.00

Schedule

ID	Task Name	Duration	4Q96	1Q97	2Q97	3Q97
1	Capability Increment 2 (CI-2)	405d				
2	Site BM/C3 Design & Engineering	96d				
3	CI-2 Site Requirements Plan	37d				
4	Site Requirements Maintenance	59d				
5	Site IF Design Described in IDD	37d				
6	Site IDD Maintenance	59d				
7	CI-2 IR	0d				
8	CI-2 Software Design	44d				
9	Software Design	44d				
10	1st Draft DWT Package Complete	0d				
11	CI-2 DWTs Complete	0d				
12	Software Implementation	217d				
13	Software Implementation Phase I	4d				
14	Software Implementation Phase II	31d				

Performance

CONL	Description	Submission Date	Frequency	Gov't Review
A001	Contract Funds Status Report	25 calendar days after end of accounting quarter	Quarterly	
A002	Cost Performance Report (CPR) - No Criteria	25 calendar days after end of accounting month	Monthly	
A003	Cost Performance Report (CPR)	25 calendar days after end of accounting month	Monthly	
A004	Funds & Man-Hour Expenditure Report	25/25/25	Monthly	N/A
A005	Data Acquisition (Lifeline) Data	30 days after contract award	Quarterly	N/A
A006	Master Integrated Program Schedule	11/30/96	Monthly	
A007	TMD Development/Program Schedule	2 weeks prior to start of TMD	Quarterly	
A008	TMD System Description Document	8/28/96	Annually	45 days
A009	TMD C3 Interface Description Document	10/29/96	Annually	45 days
A010	TMD Interoperability/Integration Document	3/30/97	Annually	N/A
A011	TMD Integrated Test Plan	1/31/97	Annually, 30 days post TMD Capstone TEMP or 90 days prior to first integration test	
A012	TMD Integrated Test Design & Assessment Plan	9/29/96 (30 days after start of A011)	30 days after start of A011	45 days



Planning

Coding

Testing

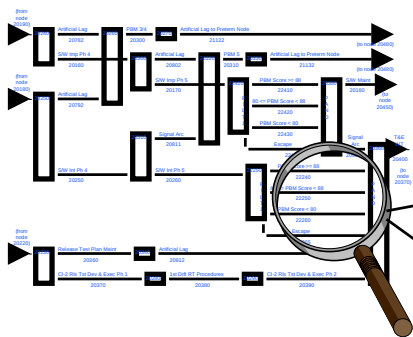
CI-1

CI-2

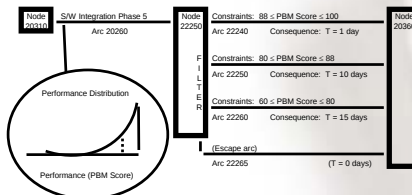
Planning

Coding

Testing



Software Integration Phase 5



- Performance Distribution
- Filter Logic w/Consequences
- 1000 Iterations

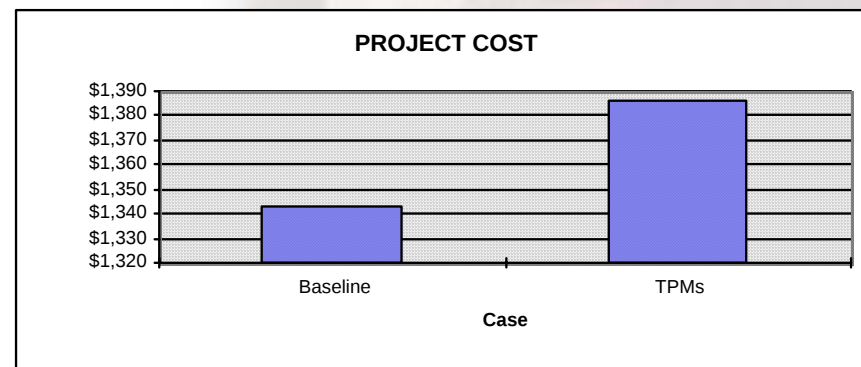
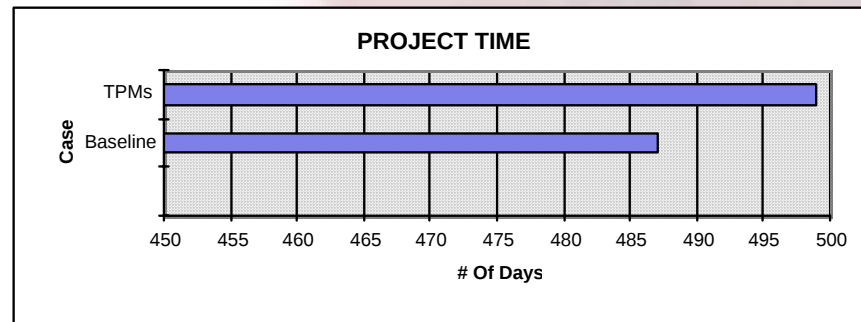
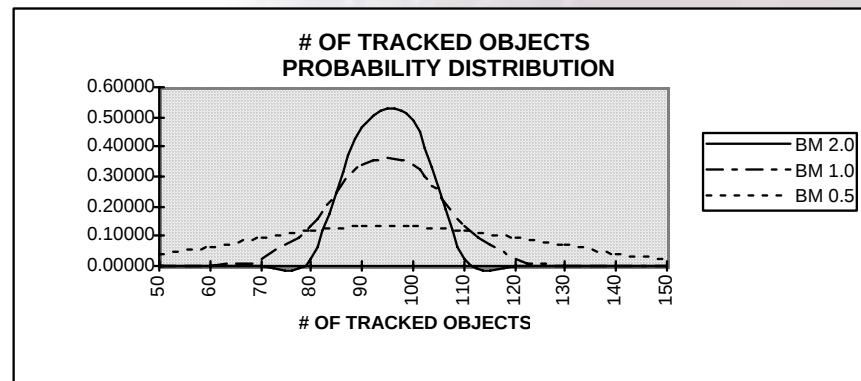
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Tracked Objects Technical Performance

Analysis Steps

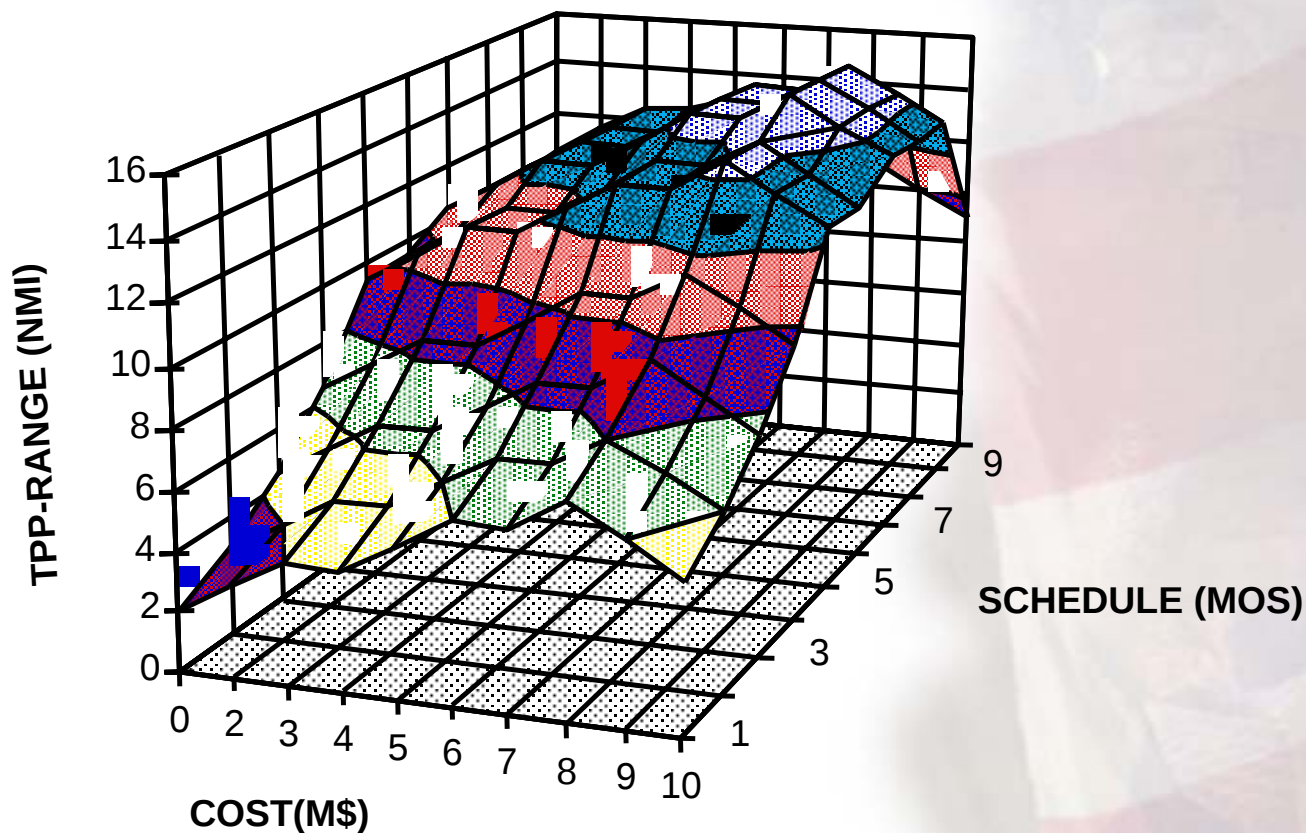
- Developed Baseline Network
- Strategically Placed Technical Performance Distributions at Appropriate Benchmark Activities
- Developed and Analyzed Pass/Fail Performance Criteria
- Accumulated Progressive Technical Performance With Narrowed Distributions
- Assessed Cost/Schedule/Technical Performance
- Produced Graphical Results for Cumulative Risk Functions



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3D Dynamics of Cost, Schedule & Performance Risk



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Approach to Software Development Program

For Each Increment Build:

Req Def.

Gov works w/ Cont to:

- Define Inc Objectives
- Trace to TPM's/ SE Req
- Define Pre-demo Chk List
- Verify Executability
 - Understand:
 - Objectives
 - Tasks
 - Resources Req'd
- Assess Cont Plan
"Can it work ?"



**Key to Success ...
realistic ... actuals
... DTC focus !!**

Design & Code

Gov :

- Understands tech details
- Guide issue resolution
- Doc decisions
- Track issue resolution

Int & Test

Gov :

- McCabe Tool (or equiv)
- Witness key testing

Pre-Demo

Pre-demo Test :

- Informal
- Verity Chk List
- Eng Lvl

Demo

Demo:

- Cont & Gov share in tech briefing
- Show traceability: TPMs/ SE Req to Chk List, Demo
- "Score Card"
- Development Performance:
 - S/W Metrics
 - Defects Removed
 - S/W Rel, Maint.
 - Issue Resolution

Start S/W Metrics
Foundation ...

... Cont to grow S/W Metrics Data Base

... Goal: Calibrate our IPT to support
Inc Build Executability Verification

Wkly
Status

Wkly
Status

Wkly
Status



Wkly
Status

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TPP/TPM Integrated Assessment Capabilities

- **Technical Design Minimums**
 - Design goal achieved
 - What resources
 - Probability of goal
 - Cost impact
- **Track Purge Applied**
 - Resources need
 - Could the goal have been met
 - Better probability of success
- **Deobligation of Funds**
 - Least affected
 - Completion Affected
 - Achievement of next event
- √ **Windfall Funds**
 - Acceleration of tasks
 - New technical goals
- √ **New Requirement**
 - Evaluate costs
 - Impact on original schedule
- √ **Network Path Analysis**
 - Time slices
 - Probability of success
- √ **Technical Goal Not Achievable**
 - What resources needed
 - What-ifs

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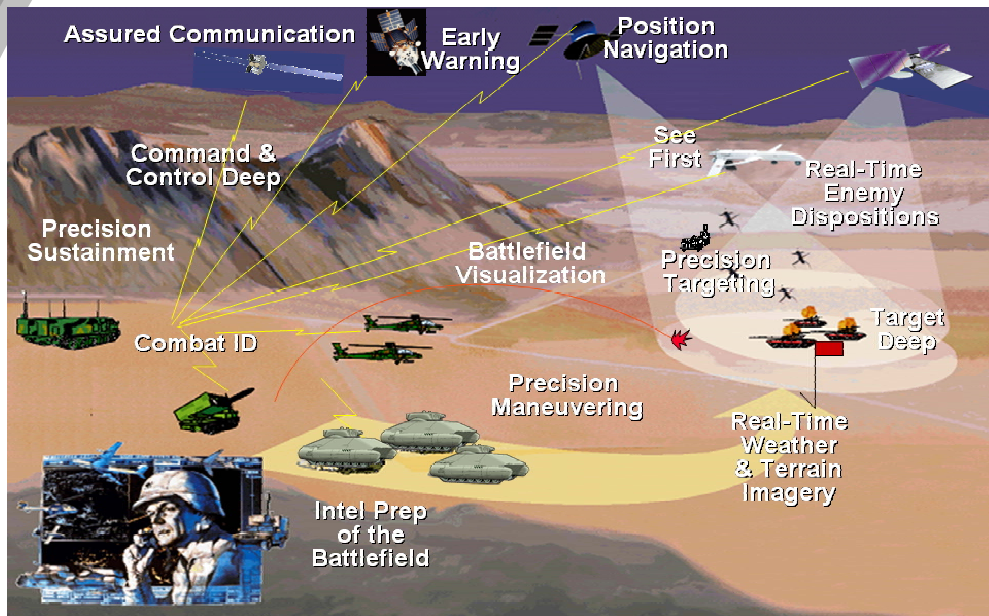


System Operational Availability

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Technical Risk & Logistics Analysis



- Performance Risk Identification /Mitigation
- System Maintenance Concept
- Weapon System Concept Trades
- Sensor vs. Interceptor Trades
- Supportability Design Criteria
- Cost

**Battlefield
Simulation**



Logistics



**Program Cost Schedule
Performance**



Life Cycle Cost/ Contractor

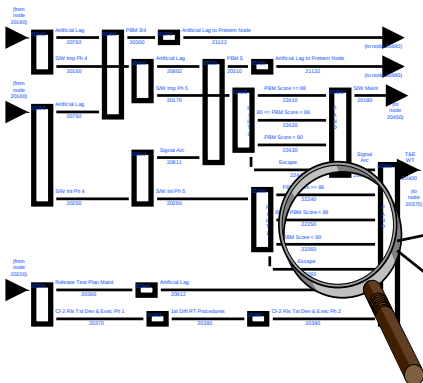
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Radar Cost/Schedule/Performance

Contract Cost

Task Name	Duration	4Q96	1Q97	2Q97	3Q97	4Q97	5Q97	6Q97	7Q97	8Q97	9Q97	10Q97	11Q97	12Q97	13Q97	14Q97	15Q97	16Q97	17Q97	18Q97	19Q97	20Q97	21Q97	22Q97	23Q97	24Q97	25Q97	26Q97	27Q97	28Q97	29Q97	30Q97	31Q97	32Q97	33Q97	34Q97	35Q97	36Q97	37Q97	38Q97	39Q97	40Q97	41Q97	42Q97	43Q97	44Q97	45Q97	46Q97	47Q97	48Q97	49Q97	50Q97	51Q97	52Q97	53Q97	54Q97	55Q97	56Q97	57Q97	58Q97	59Q97	60Q97	61Q97	62Q97	63Q97	64Q97	65Q97	66Q97	67Q97	68Q97	69Q97	70Q97	71Q97	72Q97	73Q97	74Q97	75Q97	76Q97	77Q97	78Q97	79Q97	80Q97	81Q97	82Q97	83Q97	84Q97	85Q97	86Q97	87Q97	88Q97	89Q97	90Q97	91Q97	92Q97	93Q97	94Q97	95Q97	96Q97	97Q97	98Q97	99Q97	100Q97	101Q97	102Q97	103Q97	104Q97	105Q97	106Q97	107Q97	108Q97	109Q97	110Q97	111Q97	112Q97	113Q97	114Q97	115Q97	116Q97	117Q97	118Q97	119Q97	120Q97	121Q97	122Q97	123Q97	124Q97	125Q97	126Q97	127Q97	128Q97	129Q97	130Q97	131Q97	132Q97	133Q97	134Q97	135Q97	136Q97	137Q97	138Q97	139Q97	140Q97	141Q97	142Q97	143Q97	144Q97	145Q97	146Q97	147Q97	148Q97	149Q97	150Q97	151Q97	152Q97	153Q97	154Q97	155Q97	156Q97	157Q97	158Q97	159Q97	160Q97	161Q97	162Q97	163Q97	164Q97	165Q97	166Q97	167Q97	168Q97	169Q97	170Q97	171Q97	172Q97	173Q97	174Q97	175Q97	176Q97	177Q97	178Q97	179Q97	180Q97	181Q97	182Q97	183Q97	184Q97	185Q97	186Q97	187Q97	188Q97	189Q97	190Q97	191Q97	192Q97	193Q97	194Q97	195Q97	196Q97	197Q97	198Q97	199Q97	200Q97	201Q97	202Q97	203Q97	204Q97	205Q97	206Q97	207Q97	208Q97	209Q97	210Q97	211Q97	212Q97	213Q97	214Q97	215Q97	216Q97	217Q97	218Q97	219Q97	220Q97	221Q97	222Q97	223Q97	224Q97	225Q97	226Q97	227Q97	228Q97	229Q97	230Q97	231Q97	232Q97	233Q97	234Q97	235Q97	236Q97	237Q97	238Q97	239Q97	240Q97	241Q97	242Q97	243Q97	244Q97	245Q97	246Q97	247Q97	248Q97	249Q97	250Q97	251Q97	252Q97	253Q97	254Q97	255Q97	256Q97	257Q97	258Q97	259Q97	260Q97	261Q97	262Q97	263Q97	264Q97	265Q97	266Q97	267Q97	268Q97	269Q97	270Q97	271Q97	272Q97	273Q97	274Q97	275Q97	276Q97	277Q97	278Q97	279Q97	280Q97	281Q97	282Q97	283Q97	284Q97	285Q97	286Q97	287Q97	288Q97	289Q97	290Q97	291Q97	292Q97	293Q97	294Q97	295Q97	296Q97	297Q97	298Q97	299Q97	300Q97	301Q97	302Q97	303Q97	304Q97	305Q97	306Q97	307Q97	308Q97	309Q97	310Q97	311Q97	312Q97	313Q97	314Q97	315Q97	316Q97	317Q97	318Q97	319Q97	320Q97	321Q97	322Q97	323Q97	324Q97	325Q97	326Q97	327Q97	328Q97	329Q97	330Q97	331Q97	332Q97	333Q97	334Q97	335Q97	336Q97	337Q97	338Q97	339Q97	340Q97	341Q97	342Q97	343Q97	344Q97	345Q97	346Q97	347Q97	348Q97	349Q97	350Q97	351Q97	352Q97	353Q97	354Q97	355Q97	356Q97	357Q97	358Q97	359Q97	360Q97	361Q97	362Q97	363Q97	364Q97	365Q97	366Q97	367Q97	368Q97	369Q97	370Q97	371Q97	372Q97	373Q97	374Q97	375Q97	376Q97	377Q97	378Q97	379Q97	380Q97	381Q97	382Q97	383Q97	384Q97	385Q97	386Q97	387Q97	388Q97	389Q97	390Q97	391Q97	392Q97	393Q97	394Q97	395Q97	396Q97	397Q97	398Q97	399Q97	400Q97	401Q97	402Q97	403Q97	404Q97	405Q97	406Q97	407Q97	408Q97	409Q97	410Q97	411Q97	412Q97	413Q97	414Q97	415Q97	416Q97	417Q97	418Q97	419Q97	420Q97	421Q97	422Q97	423Q97	424Q97	425Q97	426Q97	427Q97	428Q97	429Q97	430Q97	431Q97	432Q97	433Q97	434Q97	435Q97	436Q97	437Q97	438Q97	439Q97	440Q97	441Q97	442Q97	443Q97	444Q97	445Q97	446Q97	447Q97	448Q97	449Q97	450Q97	451Q97	452Q97	453Q97	454Q97	455Q97	456Q97	457Q97	458Q97	459Q97	460Q97	461Q97	462Q97	463Q97	464Q97	465Q97	466Q97	467Q97	468Q97	469Q97	470Q97	471Q97	472Q97	473Q97	474Q97	475Q97	476Q97	477Q97	478Q97	479Q97	480Q97	481Q97	482Q97	483Q97	484Q97	485Q97	486Q97	487Q97	488Q97	489Q97	490Q97	491Q97	492Q97	493Q97	494Q97	495Q97	496Q97	497Q97	498Q97	499Q97	500Q97	501Q97	502Q97	503Q97	504Q97	505Q97	506Q97	507Q97	508Q97	509Q97	510Q97	511Q97	512Q97	513Q97	514Q97	515Q97	516Q97	517Q97	518Q97	519Q97	520Q97	521Q97	522Q97	523Q97	524Q97	525Q97	526Q97	527Q97	528Q97	529Q97	530Q97	531Q97	532Q97	533Q97	534Q97	535Q97	536Q97	537Q97	538Q97	539Q97	540Q97	541Q97	542Q97	543Q97	544Q97	545Q97	546Q97	547Q97	548Q97	549Q97	550Q97	551Q97	552Q97	553Q97	554Q97	555Q97	556Q97	557Q97	558Q97	559Q97	560Q97	561Q97	562Q97	563Q97	564Q97	565Q97	566Q97	567Q97	568Q97	569Q97	570Q97	571Q97	572Q97	573Q97	574Q97	575Q97	576Q97	577Q97	578Q97	579Q97	580Q97	581Q97	582Q97	583Q97	584Q97	585Q97	586Q97	587Q97	588Q97	589Q97	590Q97	591Q97	592Q97	593Q97	594Q97	595Q97	596Q97	597Q97	598Q97	599Q97	600Q97	601Q97	602Q97	603Q97	604Q97	605Q97	606Q97	607Q97	608Q97	609Q97	610Q97	611Q97	612Q97	613Q97	614Q97	615Q97	616Q97	617Q97	618Q97	619Q97	620Q97	621Q97	622Q97	623Q97	624Q97	625Q97	626Q97	627Q97	628Q97	629Q97	630Q97	631Q97	632Q97	633Q97	634Q97	635Q97	636Q97	637Q97	638Q97	639Q97	640Q97	641Q97	642Q97	643Q97	644Q97	645Q97	646Q97	647Q97	648Q97	649Q97	650Q97	651Q97	652Q97	653Q97	654Q97	655Q97	656Q97	657Q97	658Q97	659Q97	660Q97	661Q97	662Q97	663Q97	664Q97	665Q97	666Q97	667Q97	668Q97	669Q97	670Q97	671Q97	672Q97	673Q97	674Q97	675Q97	676Q97	677Q97	678Q97	679Q97	680Q97	681Q97	682Q97	683Q97	684Q97	685Q97	686Q97	687Q97	688Q97	689Q97	690Q97	691Q97	692Q97	693Q97	694Q97	695Q97	696Q97	697Q97	698Q97	699Q97	700Q97	701Q97	702Q97	703Q97	704Q97	705Q97	706Q97	707Q97	708Q97	709Q97	710Q97	711Q97	712Q97	713Q97	714Q97	715Q97	716Q97	717Q97	718Q97	719Q97	720Q97	721Q97	722Q97	723Q97	724Q97	725Q97	726Q97	727Q97	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Contractor Schedule

ID	Task Name	Duration	4Q96	1Q97	2Q97	3Q97
1	Capability Increment 2 (CI-2)	405c				
2	Site BM/C3 Design & Engineering	96d				
3	CI-2 Site Requirements Plan	37c				
4	Site Requirements Maintenance	59c				
5	Site IF Design Described in IDD	37c				
6	Site IDD Maintenance	59c				
7	CI-2 IR	0d				
8	CI-2 Software Design	44d				
9	Software Design	44c				
10	1st Draft DWT Package Complete	0d				
11	CI-2 DWTs Complete	0d				
12	Software Implementation	217c				
13	Software Implementation Phase	4d				
14	Software Implementation Phase	31c				



Component Failure Rates

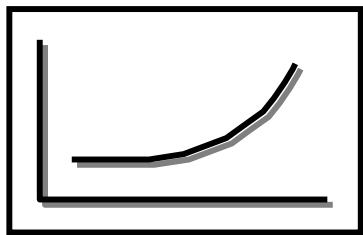
CDRL	Description	Submission Date	Frequency	Gov't Review
A001	Contract Funds Status Report	25 calendar days after end of accounting quarter	Quarterly	
A002	Cost Performance Report (CPR) - No Criteria	20 calendar days after end of accounting month	Monthly	
A003	Cost Performance Report (CPR) - Funds & Non-Funds Expenditures Report	10 calendar days after end of accounting month	Monthly	N/A
A004	Data Acquisition/Logistical Data	30 days after contract award	Quarterly	N/A



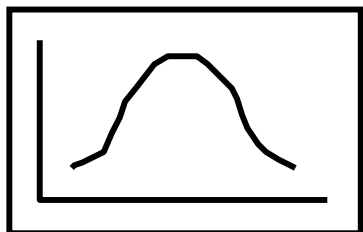
Radar Operational Availability Battlefield Environment

37% decrease in total LRU failure rate
9% decrease in Sustainment Cost
12% decrease in Leakers

**Component
Failure Rate**



Component Cost



Sustainment Simulation

LOGAM

**System Operational
Availability
System Sustainment Cost**

Battlefield Simulation

TACSIM

LEAKERS

Unclassified